

PATENT ABSTRACTS OF JAPAN

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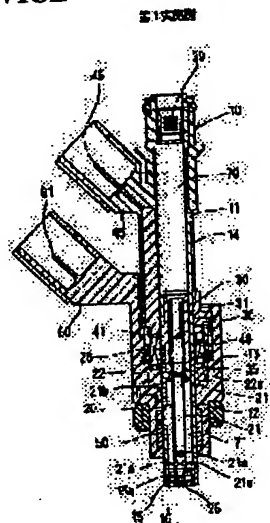
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(54) MANUFACTURING METHOD OF FUEL INJECTION DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a manufacturing method of the fuel injection device having high fuel heating efficiency, requiring no seal on an electric wire for supplying current to a heating member, and being manufactured easily.

SOLUTION: A ceramic heater 50 is cylindrically formed by sintering exothermic resistor with ceramic. The inner peripheral wall of the ceramic heater 50 directly contacts with the outer peripheral wall of a first magnetic part 12. A connector 60 is formed by resin molding of the ceramic heater 50 and the electric wire including a terminal 61 for supplying current to the ceramic heater 50. The connector 60, the ceramic heater 50, and the electric wire including the terminal 61 for supplying current to the ceramic heater 50 constitute a mounting structure. A device body of the fuel injection device 10 except for the mounting structure is assembled, and then the mounting structure is engaged with this device body from an injection hole plate 16. The end of the connector 60 in the engaging direction is locked to the device body with snap fit or the like.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the manufacture method of the fuel injection equipment of an internal combustion engine (henceforth an engine).

[0002]

[Description of the Prior Art] The emission control of vehicles is tightened up in recent years. In order to reduce the injurious ingredient contained in exhaust gas, it is important to atomize spraying injected from a fuel injection equipment. Injecting the heated fuel as one of the cures against atomization of the fuel spray, and carrying out reduced pressure boil of the fuel is known. It is effective in reduction of an injurious ingredient to carry out reduced pressure boil and to atomize the fuel especially injected at the time of starting between the colds.

[0003] Thus, the fuel injection equipment which heats and injects fuel is shown in drawing 4. The valve body 101 of a fuel injection equipment 100 is held possible [both-way movement of the nozzle needle 102], and has valve seat 101a to which the nozzle needle 102 can sit down. The coil 111 wound around the spool 110 made of a resin at the valve body periphery of the fuel upstream of valve seat 101a is arranged. Since heat occurs and the valve body 101 is heated by supplying current to a coil 111, the fuel of the fuel path 120 formed between the nozzle needle 102 and the valve body 101 as a result is heated.

[0004]

[Problem(s) to be Solved by the Invention] However, with the heating structure of the fuel shown in drawing 4, in order to insulate a coil 111 and the valve body 101 electrically and to attach a coil 111 in the valve body 101, the coil 111 is wound around the spool 110 made of a resin. Therefore, the heat generated in a coil 111 cannot get across to the valve body 101 easily. Moreover, a part of heat transmitted from the coil 111 to the spool 110 radiates heat from a spool 110. Therefore, the temperature up of the fuel of the fuel path 120 cannot be quickly carried out through the valve body 101. Furthermore, big power is needed in order to heat fuel to desired temperature. That is, the efficiency which heats fuel is a low.

[0005] A heating component is arranged in the fuel of the circumference of a needle valve, and heating fuel directly is also considered. However, if a heating component is arranged in fuel, the structure of the circumference of a heating component will become complicated. Furthermore, it is difficult to carry out the seal of the electric wiring which supplies current to a heating component. The purpose of this invention has the high heating efficiency of fuel, and its seal of the electric wiring which supplies current to a heating component is unnecessary, and it is to offer the manufacture method of the easy fuel injection equipment manufacture.

[0006]

[Means for Solving the Problem] According to the manufacture method of the fuel injection equipment of this invention according to claim 1, in the structure with a group which has the heating component which really fabricated the exoergic resistor and the insulating material, and the supporter material which supports a heating component, the inner skin of a heating component is exposed. And the structure with a group is fitted into the valve body so that the inner skin of a heating component may contact the peripheral face of the direct valve body. Since a heating component heats the direct valve body, a temperature up can be quickly carried out to the temperature of a request of the fuel in the valve body with small power. That is, the heating efficiency of fuel is high. Furthermore, since a heating component is arranged on the periphery of the valve body, it is not necessary to carry out the seal of the electric wiring which supplies current to a heating component. Furthermore, since it fits into the valve body after making into the structure with a group a heating component and the supporter material which supports a heating component, attachment of a heating component is easy.

[0007] According to the manufacture method of the fuel injection equipment of this invention according to claim 2, the ceramic heater is used for the heating component. Since the temperature up of it is carried out in an instant after a ceramic heater starts a current supply source, fuel can be promptly heated at the time of an engine starting start. Since according to the manufacture method

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of the fuel injection equipment of this invention according to claim 3 the resin mould of the heating component is carried out and the structure with a group is formed, manufacture of the structure with a group is easy.

[0008] The fuel injection equipment of this invention according to claim 4 is manufactured by the manufacture method according to claim 1, 2, or 3. A heating component contacts the direct valve body and heats the fuel in the valve body. Since fuel is heated promptly and fuel is atomized at the time of the engine starting start which the injurious ingredient discharged in exhaust gas increases, the injurious ingredient in the exhaust gas at the time of engine starting can be reduced.

[0009]

[Embodiments of the Invention] Hereafter, two or more examples which show the gestalt of operation of this invention are explained based on drawing.

(The 1st example) The fuel injection equipment by the 1st example of this invention is shown in drawing 1. The valve housing 11 is formed in the shape of [which consists of the magnetic section and the nonmagnetic section] a cylinder, for example, is formed by compound magnetism material. The fuel path 70 is formed in the valve housing 11, and the main part 15 of the valve body, the nozzle needle 20 as valve portion material, a spring 26, fixed Core 30, the adjusting pipe 31, and the filter 39 grade are held in this fuel path 70.

[0010] The valve housing 11 is really fabricated from the downward fuel-injection side in drawing 1 in order of the 1st magnetism section 12, the nonmagnetic section 13, and the 2nd magnetism section 14. It reaches 1st magnetism section 12, and the 2nd magnetism section 14 is magnetism-ized, and the nonmagnetic section 13 heats some valve housing 11, and is made nonmagnetic. It prevents magnetic flux short-circuiting the nonmagnetic section 13 between the 1st magnetism section 12 and the 2nd magnetism section 14. The main part 15 of the valve body and the nozzle hole plate 16 are held in the interior of a fuel-injection the 1st magnetism section 12 side. The valve housing 11 and the main part 15 of the valve body constitute the valve body indicated by the claim.

[0011] It is pressed fit in the 1st magnetism section 12, and was fixed to the wall of the 1st magnetism section 12 by laser welding, and the cup-like nozzle hole plate 16 is in contact with the fuel-injection side edge side of the main part 15 of the valve body. The nozzle hole plate 16 is formed in the shape of sheet metal, and two or more nozzle holes are formed in the center section.

[0012] The nozzle needle 20 as valve portion material has the body 21 currently formed by magnetic material, and the contact section 25 by which is formed by nonmagnetic material and laser welding is carried out to the nozzle hole plate 16 side wall of a body 21. The opposite section 22 by the side of fixed Core 30 of a body 21 is formed thickly, and has faced fixed Core 30. The contact section 25 can sit down to valve seat 15a formed in the main part 15 of the valve body. the fuel which penetrates the side attachment wall of a body 21 from the ceramic heater 50 as a heating component mentioned later to the body 21 of a downstream -- a hole -- two or more 21a is formed fuel -- a hole -- as for 21a, it is desirable for it not to be formed in the downstream and to be formed in the upstream of a body 21 rather than the ceramic heater 50 ***** -- carrying out -- a hole -- 21b penetrates the opposite section 22 at the root of the opposite section 22, and is formed in it

[0013] Fixed Core 30 reached nonmagnetic section 13, was held in the interior of the 2nd magnetism section 14, and has faced the opposite section 22 of the nozzle needle 20. The adjusting pipe 31 is pressed fit in fixed Core 30. The spring 26 as an energization means is stopped by the adjusting pipe 31 in one edge, and spring seat 22a of the opposite section 22 stops the other-end section. The load of a spring 26 can be changed by adjusting the amount of pressing fit of an adjusting pipe 31. The nozzle needle 20 is energized by the energization force of a spring 26 towards valve seat 15a.

[0014] magnetism -- members 35 and 36 are arranged at the periphery side of a coil 40, and touch the 1st magnetism section 12 and the 2nd magnetism section 14, respectively fixed Core 30, the opposite section 22 of the nozzle needle 20, the 1st magnetism section 12, the 2nd magnetism section 14, and magnetism -- members 35 and 36 constitute the magnetic circuit The filter 39 is attached in the upper upstream in drawing 1 of the valve housing 11, and removes the foreign matter in fuel.

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[0015] The spool 41 which is winding the coil 40 is attached in the periphery of the valve housing 11. The connector 45 which carried out the resin mould of the periphery of a coil 40 and a spool 41 has covered. The terminal 46 is laid under the connector 45 and is electrically connected with the coil 40. The ceramic heater 50 as a heating component sinters an exoergic resistor with a ceramic, and is really fabricated in the shape of a cylinder. The inner circle wall of a ceramic heater 50 touches the peripheral wall of the 1st magnetism section 12 directly.

[0016] The connector 60 as supporter material carries out the resin mould of the electric wiring including the terminal 61 which supplies current to a ceramic heater 50 and a ceramic heater 50, and is formed in them. A connector 60, a ceramic heater 50, and electric wiring including the terminal 61 which supplies current to a ceramic heater 50 constitute the structure with a group. PPS (polyphenylene sulfide) is used as resin material of a connector 60. The thermal conductivity of PPS is reducing that the heat of a ceramic heater 50 is transmitted with 0.3 W/m-K in addition to 1st magnetism section 12 since adiabatic efficiency is low high. Moreover, with about 260 degrees C, since the heat-resistant temperature of PPS is high, it does not deform at the time of heating by the ceramic heater 50.

[0017] The fuel which flowed into the fuel path 70 of the valve housing 11 through the filter 39. The fuel path in an adjusting pipe 31, the fuel path in fixed Core 30, A passage the fuel path in the nozzle needle 20, and fuel -- opening formed between the contact section 25 and valve seat 15a, when the fuel path 71 and the nozzle needle 20 which are formed between hole 21a, a body 21, and the 1st magnetism section 12 **** from valve seat 15a It is injected from the nozzle hole currently formed in the nozzle hole plate 16.

[0018] In the fuel injection equipment 10 constituted as mentioned above, when the energization to a coil 40 is turned off, with a spring 26, the nozzle needle 20 moves in the lower part, i.e., valve-closing direction, of drawing 1, the contact section 25 of the nozzle needle 20 sits down to valve seat 15a, and nozzle hole 16a is blockaded.

[0019] If the energization to a coil 40 is turned on, it will flow and the magnetic-attraction force will generate the magnetic circuit in which the magnetic flux generated in the coil 40 encloses the circumference of a coil 40 between fixed Core 30 and the opposite section 22 of the nozzle needle 20. Then, the nozzle needle 20 is attracted at a fixed Core 30 side, and the contact section 25 **** it from valve seat 15a. thereby -- the fuel path in a body 21, and fuel -- hole 21a and the fuel path 71 -- a passage -- fuel -- from nozzle hole 16a -- injecting -- having .

[0020] For example, current is supplied to a fixed time ceramic heater 50 at the time of an engine starting start. If a current supply source is started, the temperature up of the ceramic heater 50 will be carried out in an instant. Furthermore, since the ceramic heater 50 touches the 1st magnetism section 12 directly, the temperature up of the fuel of the fuel path 71 can be quickly carried out to desired temperature with small power through the 1st magnetism section 12. if the energization to a coil 40 is turned on in the state of supplying current to the ceramic heater 50 and the nozzle needle 20 separates from a valve seat -- fuel -- a hole -- 21a -- a passage -- the fuel path 71 -- the nozzle hole plate 16 side -- going -- fuel -- the inner circumference side of a ceramic heater 50 -- a passage -- a ceramic heater 50 -- contacting -- **** -- the -- one -- it is heated by the magnetic section 12 If the heated fuel is injected from nozzle hole 16a, reduced pressure boil will be carried out and fuel will be atomized. The injurious ingredient contained in exhaust gas can be reduced by supplying fixed time current to a ceramic heater 50 at the time of starting between the colds, and atomizing fuel.

[0021] When heated by the ceramic heater 50, fuel vapor may occur in the fuel of the fuel path 71. If fuel vapor collects into the fuel of the fuel path 71, fuel vapor will serve as a damper and will bar both-way movement of the nozzle needle 20. the 1st example -- ***** -- carrying out -- a hole -- most fuel vapor generated to the fuel path 71 since 21b was formed in the upstream rather than the ceramic heater 50 -- ***** -- carrying out -- a hole -- 21b -- a passage -- the fuel path 70 out of the nozzle needle 20 -- it is discharged by the upstream Therefore, the responsibility of the nozzle needle 20 improves.

[0022] Next, the manufacture method of a fuel injection equipment 10 is explained.

(1) The main part 80 of equipment shown above drawing 2 is a portion except a fuel injection

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equipment 10 to the structure 81 with a group, and is the same composition as substantially as the conventional fuel injection equipment which does not have an exchange **** wet nurse and a fuel heating means for the nozzle needle 20 of a closed-end cylinder in a solid nozzle needle. Such a main part 80 of equipment is attached.

[0023] (2) Carry out the resin mould of the electric wiring which connects electrically a ceramic heater 50, a terminal 61, and the exoergic resistor and terminal 61 of a ceramic heater 50, and form the structure 81 with a group. The inner skin of a ceramic heater 50 is exposed.

(3) Fit the structure 81 with a group into the main part 80 of equipment from the nozzle hole plate 16 side. The fitting direction edge of a connector 60 is stopped by the snap fitting etc. by the main part 80 of equipment.

[0024] (The 2nd example) The 2nd example of this invention is shown in drawing 3. The same number is substantially given to the same component with the 1st example. Since the heat insulator 51 using the steatite is arranged between the periphery of a ceramic heater 50, and a connector 60, the heat of a ceramic heater 50 cannot get across to the periphery side of a ceramic heater 50 easily. Therefore, the 1st magnetism section 12 can be heated efficiently.

[0025] In two or more above-mentioned examples of this invention explained above, the resin mould of a ceramic heater 50 and the electric wiring including the terminal 61 which supplies current to a ceramic heater 50 was carried out, the structure with a group was formed, and this structure with a group is fitted into the main part of equipment of a fuel injection equipment. Therefore, manufacture of the structure with a group is easy and attachment is easy. Moreover, since the structure 81 with a group as a fuel heating means is only fitted into the main part 80 of equipment, the conventional fuel injection equipment can be easily changed into the fuel injection equipment which has a fuel heating means.

[0026] Moreover, since the resin mould of the ceramic heater 50 is carried out, the member holding electric wiring including the terminal which supplies current to a ceramic heater 50, and the member which a ceramic heater 50 is contacted in the 1st magnetism section 12, and is attached in it can be made to serve a double purpose. Therefore, part mark and an attachment man day decrease.

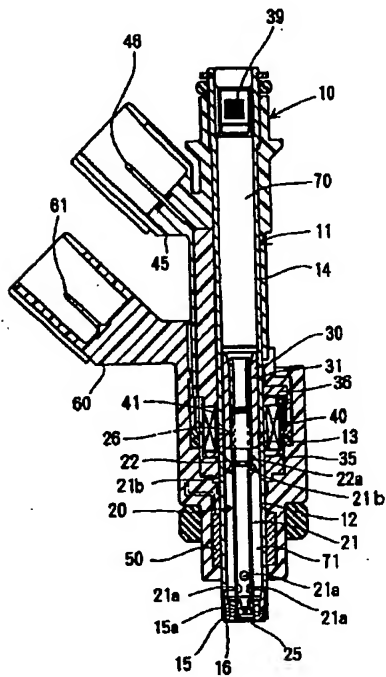
[0027] Moreover, the ceramic heater 50 is heating the 1st magnetism section 12 as the valve body directly. Therefore, the 1st magnetism section 12, i.e., fuel, can be efficiently heated with few power. Furthermore, since the ceramic heater 50 is arranged at the periphery side of the valve housing 11, it is not necessary to carry out the seal of the electric wiring which supplies current to a ceramic heater 50. In two or more above-mentioned examples, although the nozzle needle in the air was used, you may use a solid nozzle needle.

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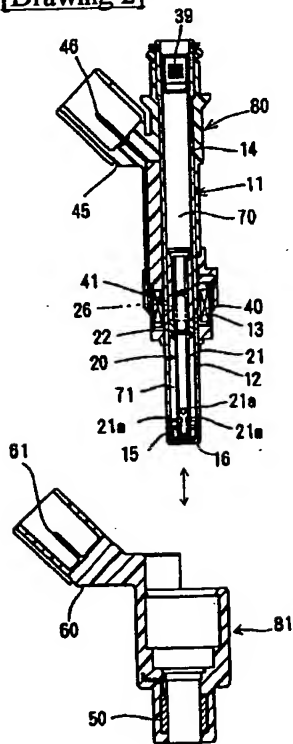
DRAWINGS

[Drawing 1]

第1実施例



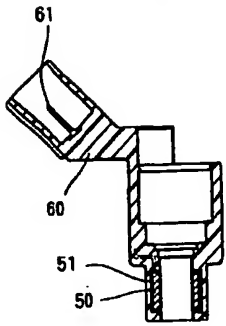
[Drawing 2]



[Drawing 3]

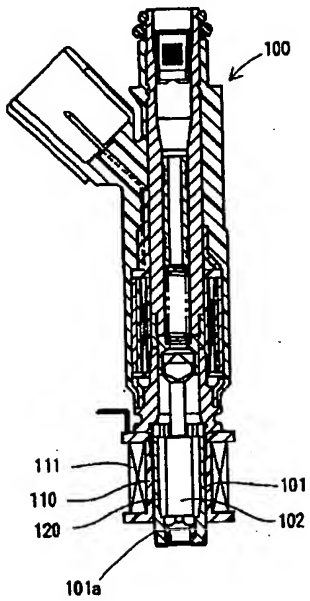
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第2實施例



[Drawing 4]

従来例



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